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(REV 10-94)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

10178.46USWO

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)
TO BE ASSIGNED

09/101569

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/FI97/00019

14 January 1997

15 January 1996

TITLE OF INVENTION

PACKET RADIO NETWORK WITH CHARGING INFORMATION COLLECTED BY NODES AND FORWARDED TO BILLING CENTRE

APPLICANT(S) FOR DO/EO/US

KARI, Hannu H. and HÄMÄKÄINEN, Jari

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An unsigned oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND of SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
TO BE ASSIGNED	PCT/FI97/00019	10178.46USWO

<p>17. [X] The following fees are submitted:</p> <p>BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)): Search Report has been prepared by the EPO or JPO.....\$930.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.492(a)(1)).....\$720.00</p> <p>No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$790.00</p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(3)) paid to USPTO \$1,070.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$98.00</p>	CALCULATIONS PTO USE ONLY																					
<p align="center">ENTER APPROPRIATE BASIC FEE AMOUNT = \$1070</p> <p>Surcharge of \$130.00 for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)). \$0</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">CLAIMS</th> <th style="width: 20%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;"></th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td align="right">13</td> <td align="right">-20 = 0</td> <td>X \$22.00</td> <td>\$0</td> </tr> <tr> <td>Independent claims</td> <td align="right">1</td> <td align="right">-3 = 0</td> <td>X \$82.00</td> <td>\$0</td> </tr> </tbody> </table> <p>MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00 \$0</p> <p align="center">TOTAL OF ABOVE CALCULATIONS = \$1070</p> <p>Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28). \$0</p> <p align="center">SUBTOTAL = \$1070</p> <p>Processing fee of \$130.00 for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). + \$0</p> <p align="center">TOTAL NATIONAL FEE = \$1070</p> <p>Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$0</p> <p align="center">TOTAL FEES ENCLOSED = \$1070</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;"></td> <td style="text-align: right;">Amount to be refunded</td> <td style="text-align: right;">\$</td> </tr> <tr> <td></td> <td style="text-align: right;">charged</td> <td style="text-align: right;">\$</td> </tr> </table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		Total claims	13	-20 = 0	X \$22.00	\$0	Independent claims	1	-3 = 0	X \$82.00	\$0		Amount to be refunded	\$		charged	\$
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	Amount to be refunded	\$																				
	charged	\$																				

i. [X] Check in the amount of **\$1070** to cover the above fees is enclosed.

j. [] Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

k. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-2725.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive 37 CFR 1.37(a) or (b)) must be filed and granted to restore the application to pending status.

END ALL CORRESPONDENCE TO:
Michael B. Lasky
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3100 Northwest Center
90 South Seventh Street
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SIGNATURE

Michael B. Lasky
NAME

29,555
REGISTRATION NUMBER

101 Radi PCT/PT 13 JUL 1998
09/101569

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: KARI, Hannu, H. and HÄMÄLÄINEN, Jari Docket No.: 10178.46USWO
Serial No.: TO BE ASSIGNED (Corresponding to PCT/FI97/00019)
Filed: 13 July 1998
International Filing Date: 14 January 1997

Title: PACKET RADIO NETWORK WITH CHARGING INFORMATION
COLLECTED BY NODES AND FORWARDED TO BILLING CENTRE

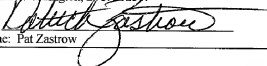
CERTIFICATE UNDER 37 CFR 1.10:

"Express Mail" mailing label number: EN022081632US

Date of Deposit: 13 July 1998

I hereby certify that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

By:



Name: Pat Zastrow

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please
enter the following preliminary amendment:

IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page
thereof.

IN THE SPECIFICATION

Enclosed is a copy of Form PCT/IB/308 indicating communication of the
international application to the Designated Offices. A courtesy copy of the present
specification is enclosed herewith, however, but the World Intellectual Property Office
(WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

IN THE CLAIMS

Please amend the claims as follows:

In Claim 3, line 29, please replace "as claimed in claim 1 or 2" with — as claimed in claim 1—.

In Claim 4, lines 1 and 2, please replace "as claimed in claim 1, 2, or 3" with —as claimed in claim 1—.

In Claim 5, lines 7 and 8, please replace " as claimed in any one of the previous claims" with — as claimed in Claim 1—.

In Claim 6, lines 11 and 12, please replace " as claimed in any one of the Claims 1–5" with —as claimed in Claim 1—.

In Claim 7, lines 17 and 18, please replace "as claimed in any one of the previous claims" with —as claimed in Claim 1—.

In Claim 8, lines 22 and 23, please replace "as claimed in any one of claims 1–6" with —as claimed in Claim 1—.

In Claim 10, lines 32 and 33, please replace " as claimed in claim 8 or 9" with —as claimed in Claim 8—.

Please add the following new claims:

11. (New) A method as claimed in Claim 2, characterized in that the communication protocol between the billing gateway support node (BGGSN), the packet radio support nodes (SGGSN) and the gateway packet radio support nodes (GGSN) is independent of a communication protocol between the gateway support node and the charging system.

12. (New) A packet radio network as claimed in Claim 2, characterized in that the communication protocol between the billing gateway support

node (BGGSN) and the charging system is different from a packet switched communication protocol of said internal backbone network.

13. (New) A packet radio network as claimed in Claim 3, characterized in that the communication protocol between the billing gateway support node (BGGSN) and the charging system is different from a packet switched communication protocol of said internal backbone network.

REMARKS

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

The above preliminary amendment is made to remove multiple dependencies from claims.

Applicant respectfully requests that the preliminary amendment described herein be entered into the record prior to calculation of the filing fees and prior to examination and consideration of the above-identified application.

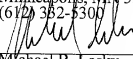
If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's primary attorney-of record,

Respectfully submitted,

MERCHANT, GOULD, SMITH, EDELL,
WELTER & SCHMIDT, P.A.
3100 Northwest Center
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Dated: 13 July 1998

By:


Michael B. Lasky
Reg. No. 29,555
MBL/ssh

09/101569

ABSTRACT

In a digital mobile communication system, a packet radio system has been implemented by employing the radio interface of the mobile communication network. The packet radio system comprises packet radio support nodes (SGSN) connected to the mobile communication network, as well as gateway support nodes for providing an inter-connection to an external packet data network (15). The support nodes (SGSN, GGSN) are connected to an intra-operator packet switched backbone network (13). The serving support nodes and the gateway support nodes collect charging information on usage of the radio interface and the data network (15), respectively. The system is further provided with a billing gateway support node (BGGSN) connected to the internal backbone network (BGGSN) to receive user-specific charging information collected by the other support nodes, and to forward the charging information to a charging system.

CERTIFICATE UNDER 37 CFR 1.10:

"Express Mail" mailing label number: EN022081632US

Date of Deposit: 13 July 1998

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By: 

Name: Pat Zastrow

~~SECRET~~ Rec'd 13 JUL 199809/101569
PCT/FI97/00019

1

PACKET RADIO NETWORK WITH CHARGING INFORMATION COLLECTED BY NODES AND
FORWARDED TO BILLING CENTREField of the Invention

5 The present invention relates to packet radio
networks and particularly to carrying out charging in
packet radio networks.

Background of the Invention

10 Mobile communication systems have been developed in
order to make people free to move away from fixed
telephone terminals without, however, making them more
difficult to reach. With an increasing usage of data
transfer services in offices, various kinds of data
15 services have been introduced to the mobile communication
systems as well. Portable computers enable efficient data
processing wherever the user may be. Mobile communication
networks, in turn, provide users with an efficient access
network for mobile data transfer, the access network
providing access to actual data networks. For this
20 purpose, various new forms of data service are being
planned in present and future mobile communication
networks. Mobile data transfer is particularly well
supported by digital mobile communication systems, such as
the Pan-European mobile communication system, GSM (Global
System for Mobile Communication).

25 A new service in the GSM system is provided by GPRS
(General Packet Radio Service), which is one of the topics
for GSM stage 2+ standardization work being done in ETSI
(European Telecommunication Standard Institute). The GPRS
operational environment is constituted by one or more
30 subnetwork service areas which are inter-connected by a
GPRS Backbone Network. The subnetwork comprises a group of
packet data service nodes SN, herein referred to as
serving GPRS support nodes SGSN, each of which is
connected to the GSM mobile communication network so that
35 it is able to provide mobile data terminal equipments with

a packet data service via a multitude of base stations i.e. cells. The mobile communication network in between offers a packet switched data transfer between the support node and the mobile data terminal equipments. The different subnetworks, in turn, are connected to an external data network, e.g. to a packet switched public data network PSPDN, via specific gateway GPRS support nodes, GGSN. Thus, the GPRS service provides packet data transfer between mobile data terminal equipments and external data networks with the GSM network serving as an access network. One of the features of the GPRS service network is that it operates almost independently of the GSM network with the "conventional" GSM network services.

One of the problems is how to carry out charging in the GPRS network. User-related data transmission statistics, used for charging the user, are normally gathered at the serving GPRS support nodes SGSN and at the gateway GPRS support nodes GGSN. The SGSN collects information about the radio interface usage and the GGSN collects information about the data network usage. The number of SGSNs and GGSNs in an MSC service area can be quite high, tens or even hundreds of nodes. However, no suggestions exist as to how to carry out charging using such scattered charging information. In the GSM mobile communication network, the billing records (Call Detailed Records) are typically generated at the mobile communication network or in an Intelligent Network IN coupled thereto. However, there are no direct interfaces from the GPRS system to the mobile network or the IN suitable also for the GPRS charging. A further problem is that the billing centers and the interfaces they use have not been standardized even in the mobile communication networks and are consequently different for every operator. This would require implementing different interfaces in different GPRS networks. Similar problems

may also occur in other packet radio networks of the GPRS network type.

Brief Summary of the Invention

It is object of the present invention to enable
5 billing in packet radio networks.

A further object of the present invention is a charging information collecting system which is independent of the billing system implementation in a packet radio network.

10 The invention relates to a packet radio system comprising a digital mobile communication network; packet data terminal equipments; packet radio support nodes connected to the mobile communication network which provides them with a radio interface for packet switched
15 data transmission with the packet data terminal equipments; gateway packet radio support nodes providing an access point to an external packet data network; and an internal packet switched backbone network to which the packet radio support nodes and the gateway packet radio
20 support nodes are connected. The packet radio network according to the invention further comprises a billing gateway support node, which is connected to said internal backbone network to receive user-specific charging information collected by other support nodes and to
25 forward the charging information to the billing system.

The basic idea of the invention is to provide the internal backbone network of the packet radio network with a new support node establishing a gateway from the packet radio network to the actual billing system. This support
30 node is herein referred to as a billing gateway GPRS support node BGGSN. As the BGGSN is connected to the packet switched backbone network within the packet data network, it is possible to exchange information between the BGGSN and any other support node in the packet radio
35 system, even in case the nodes are in packet radio

networks controlled by different operators. The transmitting support node only needs to know the address of the receiving support node. Between the support nodes that collect charging information and the BGGSNs, a communication protocol can be determined which is independent of the implementation of the operator's charging system, and the same in all the packet radio networks. In case the support node collecting charging information wishes to transmit charging information of a specific subscriber, it transmits the information to a specific billing gateway GPRS support node which forwards the charging information, either directly or indirectly, to the operator's charging system.

The communication protocol between the billing gateway GPRS support node and the operator's billing system may be operator-specific. The other support nodes in the packet radio network, however, need not know the implementation of this interface as the interface between the support nodes and the billing gateway GPRS support node is standard.

The invention provides a number of advantages. In the packet radio network, only one charging interface is determined. Charging in the packet radio network is standardized, but it is not restricted to one embodiment or charging system communication protocol. The operator only needs one interface for the charging system, and not e.g. a dedicated interface in every support node. The operator may send charging information directly to another operator, from one billing gateway GPRS support node to another.

Brief Description of the Drawings

In the following, the invention will be described by means of its preferred embodiments, with reference to the attached drawing in which the GPRS system according to the invention is shown.

The present invention is applicable to different types of packet radio systems in which support nodes are connected by a common backbone network. The invention is particularly well applicable to implementing a General Packet Radio Service (=GPRS) in the Pan-European digital mobile communication system GSM (Global System For Mobile Communication) or similar mobile communication systems, such as the DCS1800 and the PCS (Personal Communication System). Below, the preferred embodiments of the invention will be described by means of a GPRS packet radio network, which is a combination of the GPRS service and the GSM system, without, however, restricting the invention to such a specific packet radio system.

The figure illustrates a GPRS packet radio network implemented in the GSM system.

The basic structure of the GSM network consists of two parts: a base station system BSS and a network subsystem NSS. The BSS and mobile stations MS communicate through radio connections. Within the BSS each cell is served by a base station BTS. A number of base stations is connected to a base station controller BSC whose function is to control radio frequencies and channels used by the BTS. The BSCs are connected to a mobile services switching center MSC. For a more detailed description of the GSM system, reference is made to the ETSI/GSM recommendations and "The GSM System for Mobile Communications", M. Mouly and M. Pautet, Palaiseau, France, 1992, ISBN:2-9507190-07-7.

In the figure, the GPRS system connected to the GSM system comprises two GPRS operators; operator 1 and operator 2, both having two serving GPRS support nodes (SGSN) and a gateway GPRS support node (GGSN). The different support nodes SGSN and GGSN are interconnected by an Intra-Operator Backbone Network. It should be understood that the GPRS network may have any number of

support and gateway nodes.

In a cellular packet radio network, each support node SGSN controls a packet data service within the area of one or more cells. For this purpose, each support node
5 SGSN is connected to a specific local part of the GSM mobile communication system. This connection is typically to the mobile services switching center, but in some cases it might prove advantageous to make the connection directly to the base station system BSS, in other words,
10 to the BSC or one of the base stations BTS. A mobile station MS in a cell communicates over the radio interface with the base station BTS and further, via the mobile communication network, with the support node SGSN in whose service area the cell is located. In principle, the mobile
15 communication network between the support node SGSN and the mobile station MS may forward packets between these two. For this purpose, the mobile communication network may offer either a circuit switched connection or a packet switched data packet transfer scheme between the mobile
20 station MS and the serving support node SGSN. An example of a circuit switched connection between a mobile station MS and a support node (Agent) is disclosed in the Finnish patent application 934115. An example of a packet switched
25 data transfer between a mobile station MS and a support node (Agent) is disclosed in the Finnish patent application 940314. However, it should be noted that the mobile communication network only provides a physical connection (access network) between the MS and the SGSN, and its exact operation or structure have no relevance to
30 the present invention.

The intra-operator backbone network 13, which interconnects the apparatuses SGSN and GGSN of the operator, may be implemented e.g. by a local area network, such as an IP network, a CLNP network or an X.25 network.
35 It should be noted that an operator's GPRS network may

also be implemented without an intra-operator backbone network, for example by implementing all the features in one and the same computer; such an alteration does not change the charging principles of the invention.

5 The gateway GPRS support node GGSN connects the operator's GPRS network to the GPRS systems of other operators and to data networks 15, such as an Inter-Operator Backbone Network, an IP network (Internet) or an X.25 network.

10 The inter-operator backbone network is a network through which the GGSNs of different operators may communicate with one another. This communication is required to support GPRS roaming between different GPRS networks. The inter-operator backbone network may be
15 implemented by using e.g. an X.25, IP, CLNP or other networks as long as the GGSN of both sides employ the same protocols toward the backbone network between the operators. To take an example, if the intra-operator network is an IP network, an operator 1 may have an
20 internal X.25 network (in the intra-backbone network of operator 1), and an operator 2 may have an internal CLNP network (in the intra-backbone network of operator 2). In such a case, the GPRS GSN of the operator 1 should use X.25 protocol locally and the IP protocol toward the
25 inter-operator backbone network. Similarly, the GPRS GSN of the operator 2 should use the CLNP protocol locally and the IP protocol toward the inter-operator backbone network. It should be noted that if the networks of both the operators and the network in between all use the same
30 protocol, the GGSNs between them is not necessarily required but they may be replaced by e.g. data network bridges or routers.

 The gateway GPRS support node GGSN is also used for storing location information of GPRS mobile stations. The
35 GGSN also routes mobile-terminating (MT) data packets. The

GGSN also comprises a database which maps together the network address of the mobile station, e.g. in the IP, X.25, or CLNP network, or simultaneously in a plurality of them, and the GPRS roaming identity of the mobile station in the GPRS network.

User-related data transfer statistics, used for charging the user, are also collected mainly at the serving GPRS support nodes SGSN, and in the gateway GPRS support nodes GGSN. The SGSN collects information about the radio interface usage and the GGSN collects information about the data network usage. Typically, charging in the packet radio system consists of subscriber fees and traffic fees. The subscriber fee is a regular payment paid by the subscribers to cover a specific period of time. The traffic fees are typically determined in a packet radio network as a function of data amount and service type, possibly service quality as well. The data amount measuring techniques may include simply counting the bytes or an advanced statistical sampling of the data traffic. In principle, charging for usage of a packet radio network should be possible the same way as in general packet switched data networks. The exact charging basis may be operator-specific. The charging principles are not significant as far as the present invention is concerned, because it is generally applicable to different charging methods.

The operator's billing system, which carries out the final subscriber billing on the basis of the charging information collected, may be located freely as it is not a part of the actual packet radio network. In the example of the figure, the charging system is placed apart from the actual packet radio network in a specific charging center BC. Alternatively, it may be situated e.g. at the MSC. The exact implementation of the charging center BC may vary operator-specifically. The exact implementation

of the BC is not essential to the present invention, because it is generally applicable to different charging centers.

The internal backbone network of the packet radio network according to the invention is provided with a new support node, which provides a gateway from the packet radio network to the actual charging system, such as the charging center BC. This support node is herein referred to as a billing gateway GPRS support node BGGSN. As the BGGSN is connected to the intra-operator packet switched backbone network, it is possible to exchange information between the BGGSN and any other support node SGSN or GGSN in the packet radio network, even if the nodes are in packet radio networks of different operators. The transmitting support node only need to know the address of the receiving support node. Between the support nodes SGSN or GGSN that collect charging information and the BGGSNs there exists a communication protocol which is independent of the implementation of the operator's charging system, and the same in all the packet radio networks. In case the SGSN or GGSN collecting charging information wishes to transmit charging information of a specific subscriber (identified with e.g. an international mobile subscriber identity IMSI in the GPRS system) to the charging center BC, it transmits the information in data packets corresponding to the protocol (e.g. IP) of the backbone network, the data packets containing the network address (e.g. IP address) of a specific BGGSN. The data field of the data packet may contain the charging information in a suitable format. The data field may contain subfields which contain the IMSI, data amount and the service type. The BGGSN receiving the data packet forwards the charging information to the operator's charging center BC. The exact implementation of the protocol used in the charging information transfer is not essential to the invention,

but the invention is generally applicable to all the protocols. The BGGSN may also buffer, combine or pre-process the charging information in some other way before sending it to the BC.

- 5 The BGGSN address to which other support nodes send charging information may be either fixed or dynamic. In the former case, the support node SGSN or GGSN always sends the charging information to the same BGGSN whose address is permanently stored in the support node. In the
- 10 latter case, the BGGSN to which the charging information is sent varies e.g. according to the service type or subscriber. In case the address varies according to subscribers, the address of the correct BGGSN is given to the support node when the subscriber begins to use a GPRS service. The BGGSN to which the support node sends the
- 15 charging information may be within the network of the same or a different operator. For example, the SGSN in the network controlled by the operator 1 may send charging information to the BGGSN of the same network, when the
- 20 subscriber's home network is the network of the operator 1. However, the same SGSN may also send charging information to the BGGSN of the operator 2, when the home network of the subscriber 2 is the network controlled by the operator 2 and the subscriber is roaming in the
- 25 network of the operator 1. In such a case, a data packet containing the charging information is routed from one network to another the same way as other data packets. In a similar manner, the BGGSNs (and consequently BCs) of different operators may also exchange information by
- 30 sending data packets from one network to another via the inter-operator backbone network or data network. It is also possible that the SGSN sends the charging information to the BGGSN of the operator 1, even if the home network of the subscriber 2 is the network controlled by the
- 35 operator 2 and the subscriber is roaming in the network of

the operator 1 (the visitor network).

The BGGSN may be connected to the BC either directly (as the operator 1 BGGSN connection 12 in the figure), or indirectly via an intermediate network (such as an intelligent network IN) or a network element (as the operator 2 BGGSN connection 12 in the figure). The connection and communication protocol between the BGGSN and the operator's charging center BC may be operator-specific. It may be based e.g. on SS7 (Signalling System 7) employed by e.g. the GSM system. The connection and the communication protocol are not significant as far as the invention is concerned, as the invention is meant to be generally applicable to all the solutions.

The description is only intended to illustrate the preferred embodiments of the present invention. The invention is not to be restricted to these examples, but it may be modified within the scope of the attached claims.

Claims

1. A packet radio system comprising:
a digital mobile communication network (BTS, BSC,
5 MSC);
packet data terminal equipments (MS);
packet radio support nodes (SGSN) connected to the
mobile communication network which provides them with a
radio interface for packet switched data transmission with
10 the packet data terminal equipments;
gateway packet radio support nodes (GGSN) providing
an access point to an external packet data network (15);
and
an internal packet switched backbone network (13)
15 to which the packet radio support nodes (SGSN) and the
gateway packet radio support nodes (GGSN) are connected,
c h a r a c t e r i z e d by
a billing gateway support node (BGGSN), connected
to said internal backbone network (BGGSN) to receive user-
20 specific charging information collected by the other
support nodes (SGGSN, GGSN) and to forward the charging
information to the charging system.
2. A method as claimed in claim 1,
c h a r a c t e r i z e d in that the communication
25 protocol between the billing gateway support node (BGGSN),
the packet radio support nodes (SGGSN) and the gateway
packet radio support nodes (GGSN) is a packet switched
communication protocol of said internal backbone network.
3. A method as claimed in claim 1 or 2,
30 c h a r a c t e r i z e d in that the communication
protocol between the billing gateway support node (BGGSN),
the packet radio support nodes (SGGSN) and the gateway
packet radio support nodes (GGSN) is independent of a
communication protocol between the gateway support node
35 and the charging system.

4. A packet radio network as claimed in claim 1, 2 or 3, c h a r a c t e r i z e d in that the communication protocol between the billing gateway support node (BGGSN) and the charging system is different from a packet switched communication protocol of said internal backbone network.

5. A packet radio network as claimed in any one of the previous claims, c h a r a c t e r i z e d in that the billing gateway support node (BGGSN) is provided with a direct connection to the billing system.

6. A packet radio network as claimed in any one of claims 1-5, c h a r a c t e r i z e d in that the billing gateway support node (BGGSN) is connected to the billing system via an intermediate network, such as an intelligent network, or via an intermediate network element, such as a mobile services switching center (MSC).

7. A packet radio network as claimed in any one of the previous claims, c h a r a c t e r i z e d in that the address of the billing gateway support node (BGGSN) to which the other support nodes send charging information is fixed.

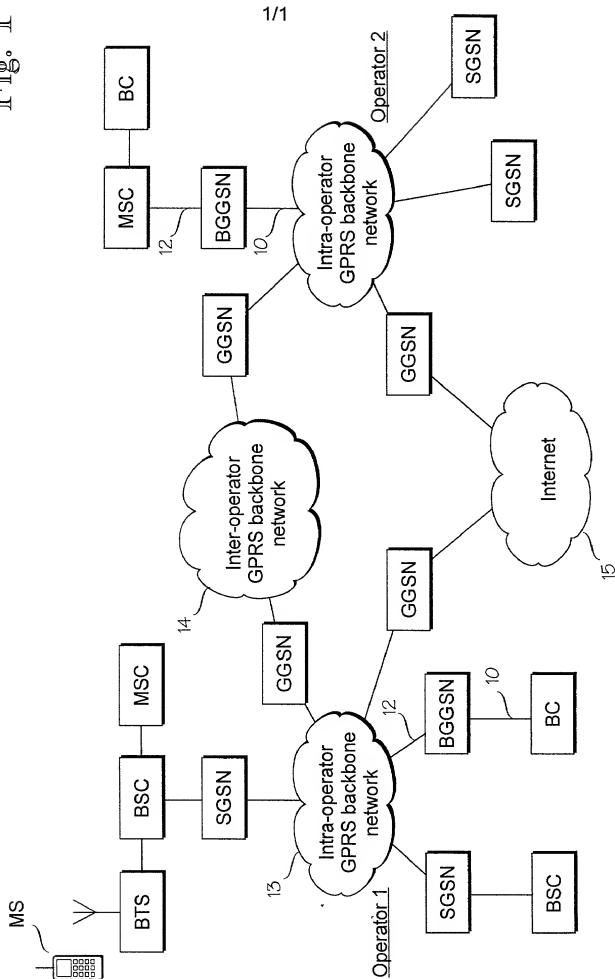
8. A packet radio network as claimed in any one of claims 1-6, c h a r a c t e r i z e d in that the address of the billing gateway support node (BGGSN) to which the other support nodes send charging information is dynamic.

9. A packet radio network as claimed in claim 8, c h a r a c t e r i z e d in that the address of the billing gateway support node (BGGSN) to which the other support nodes send charging information is subscriber-specific and is given to the respective other support node when the subscriber begins using a service.

10. A packet radio network as claimed in claim 8 or 9, c h a r a c t e r i z e d in that the support nodes are arranged to send the charging information to the billing gateway support node (BGGSN) of the subscriber's home

network or the visited network.

Fig. 1



MERCHANT & GOULD

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Packet radio network with charging information collected by nodes and
forwarded to billing centre

The specification of which

a. ☐ is attached hereto

b. ☐ was filed on _____

as application serial no. _____

and was amended on _____ (if applicable)

(in the case of PCT-filed application)

described and claimed in international no. PCT/FI97/00019 filed 14 January 1997

and as amended on _____ (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(s). (Reprinted on back side).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent of inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

a. ☐ no such applications have been filed.

b. ☒ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
Finland	960185	15/01/1996	
ALL FOREIGN APPLICATIONS, IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS(patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization/who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant, Gould to the contrary.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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DATE		DATE		DATE
1.10.98		5.10.98		

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☐ Check box and attach sheet with same information, including date and signature.